

ARTICLE OF APPAREL WITH AREAS OF INCREASED TENSION

FIELD OF THE INVENTION

- [01] This invention relates generally to an article of apparel, and, in particular, to an article of apparel that has areas of increased tension when worn by a user, providing improved conformity to a user's body.

BACKGROUND OF THE INVENTION

- [02] Certain articles of apparel, such as performance swimwear, may be formed of a stretchable material, such as polyester, spandex or nylon, which conforms, for the most part, tightly to the user's body. However, such stretchable materials tend to tent between anatomical high points of the user's body, creating areas where the swimsuit is not in contact with the swimmer. Exemplary tenting areas include between the pectoral muscles, between the breasts, and in the lumbar region of the user's back. A problem encountered when swimming with a swimsuit that tents is that once the swimsuit is submerged, these areas fill with water, forcing the swimmer to carry more mass, resulting in more hydrodynamic drag and reduced performance.
- [03] Previous attempts to address this issue include patterning the swimsuit through the use of additional seams in areas where tenting occurs. The seams typically stretch less than the surrounding material, reducing the tenting effect. However, conventional seams create additional drag, thereby diminishing the advantage provided by the additional seams.
- [04] It is an object of the present invention to provide an article of apparel that reduces or overcomes some or all of the difficulties inherent in prior known devices. Particular objects and advantages

of the invention will be apparent to those skilled in the art, that is, those who are knowledgeable or experienced in this field of technology, in view of the following disclosure of the invention and detailed description of certain preferred embodiments.

SUMMARY

- [05] The principles of the invention may be used to advantage to provide an article of apparel with areas with increased tension when the apparel is donned by the user.
- [06] In accordance with a first aspect, an article of apparel having improved body conformity includes a body of material formed of a stretchable fabric. A stretchable piece of material is secured to the body of material and has a size and shape configured to at least partially cover an area of a user's body between anatomical high points of the user's body.
- [07] In accordance with another aspect, a swimsuit having improved body conformity includes a swimsuit body formed of a stretchable fabric. A stretchable piece of material is secured to the swimsuit body and has a size and shape configured to at least partially cover an area of a user's body between anatomical high points of the user's body.
- [08] Substantial advantage is achieved by providing an article of apparel having areas with increased tension. For example, a swimsuit in accordance with the present invention can be provided with areas of increased tension when the swimsuit is donned by the user. The areas of increased tension reduce the tendency of a pocket forming where tenting is likely to occur in areas between elevated portions of the user's anatomy. This is highly advantageous since it reduces the tendency of water accumulating within these areas, allowing the user to carry less mass, resulting in less hydrodynamic drag and improved performance.

- [09] These and additional features and advantages of the invention disclosed here will be further understood from the following detailed disclosure of certain preferred embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

- [10] FIG. 1 is a front elevation view of an article of apparel in accordance with a preferred embodiment of the present invention.
- [11] FIG. 2 is a section view, taken along line 2-2 of FIG. 1, of an area of increased tension of the article of apparel of FIG. 1.
- [12] FIG. 3 is a rear elevation view of an article of apparel in accordance with another preferred embodiment of the present invention.
- [13] FIG. 4 is a front perspective view of an alternative embodiment of an article of apparel in accordance with the present invention.
- [14] FIG. 5 is a front elevation view of another alternative embodiment of an article of apparel in accordance with the present invention.
- [15] FIG. 6 is a rear elevation view of yet another alternative embodiment of an article of apparel in accordance with the present invention.
- [16] The figures referred to above are not drawn necessarily to scale and should be understood to provide a representation of the invention, illustrative of the principles involved. Some features of the article of apparel having areas with increased tension depicted in the drawings have been enlarged or distorted relative to others to facilitate explanation and understanding. The same reference numbers are used in the drawings for similar or identical components and features

shown in various alternative embodiments. Articles of apparel having areas with increased tension as disclosed herein would have configurations and components determined, in part, by the intended application and environment in which they are used.

DETAILED DESCRIPTION OF CERTAIN PREFERRED EMBODIMENTS

- [17] The present invention may be embodied in various forms. A preferred embodiment of an article of apparel 10 is illustrated as a swimsuit 10 in FIG. 1. Although the embodiment illustrated here is a swimsuit, it is to be appreciated that articles of apparel other than swimsuits are considered to be within the scope of the present invention. In preferred embodiments, swimsuit 10 is formed of a stretchable material, which allows the swimsuit to be stretched over the user's body and conform tightly to their anatomy in a tight-fitting manner, which reduces drag as the user swims through the water.
- [18] Swimsuit 10 has at least one area 12 having increased tension when swimsuit 10 is donned by a user. Increased tension area 12 is preferably positioned in an area on the user's body between two or more anatomical high points. In the embodiment illustrated in FIG. 1, first increased tension area 12 is positioned between the breasts of the user on the front 14 of swimsuit 10. The construction of increased tension area 12 in a preferred embodiment is seen more clearly in FIG. 2. In this embodiment, a piece of material 20 is secured to an interior surface 22 of the body of swimsuit 10 by way of an adhesive element 24. Although material 20 in this embodiment is secured to interior surface 22 of swimsuit 10, it is to be appreciated that material 20 may be secured to the exterior surface of swimsuit 10 in other preferred embodiments. Material 20 may have any desired shape, and preferably substantially covers an area on the user's body between anatomical high points where swimsuit 10 has a tendency to tent. In this embodiment, as seen in

FIG. 1, material 20 is formed of three elongate elements 23 extending outwardly from a central portion 25, with the elongate elements being spaced approximately 120° from one another.

- [19] In a preferred embodiment, piece of material 20 is formed of the same material as that of swimsuit 10. Exemplary materials for swimsuit 10 and piece of material 20 include polyester, LYCRA® (a type of spandex), nylon, and elastane. In a preferred embodiment, swimsuit 10 and material 20 are formed of a blend of polyester and spandex. Other suitable materials will become readily apparent to those skilled in the art, given the benefit of this disclosure.
- [20] Adhesive element 24 may be a thermoplastic polymer that bonds to swimsuit 10 and material 20 through the application of heat and pressure, providing a secure bond and compressing swimsuit 10 and material 20 together. The amount of heat and pressure required to form adequate bonds will vary depending on the actual material used for adhesive element 24. Exemplary materials for adhesive element 24 include polyurethane, polyamide, polyester, polyolefin, vinyl, and silicone. Suitable thermoplastic polymers formed from one or more of these materials may be supplied by Bemis Associates, Inc. of Shirley, Massachusetts. As illustrated, the heat and pressure induces adhesive element 24 to soften or melt to the extent that it infiltrates the structure of swimsuit 10 and material 20. Once it has cooled, adhesive element 24 securely bonds swimsuit 10 and material 20 together. In other embodiments, adhesive element 24 may be a material that forms the bonds through radio frequency or ultrasonic bonding. Other suitable adhesive materials will become readily apparent to those skilled in the art, given the benefit of this disclosure.
- [21] It is to be appreciated that in certain preferred embodiments, adhesive element 24 may be initially applied to one of swimsuit 10 and material 20 by way of a platen of a heating apparatus

(not shown), which subjects adhesive element 24 and the swimsuit 10 or material 20 to heat and pressure to create an adhesive bond. A carrier sheet (not shown) of paper, a polymer having a higher melting temperature than that of adhesive element 24, or any other suitable material, is typically used on one side of adhesive element 24 to prevent the adhesive from bonding to the heating apparatus. Subsequent to applying adhesive element 24 to swimsuit 10 or material 20, the carrier sheet is removed and the heating apparatus is then used to bond the other of swimsuit 10 or material 20. It is to be appreciated that radio frequency and ultrasonic bonding may also be utilized to form the bonds between adhesive element 24 and swimsuit 10 or material 20. It is to be appreciated that adhesive element 24 may also be bonded simultaneously to both swimsuit 10 and material 20.

- [22] The degree of heat utilized to melt adhesive element 24 is primarily dependent upon the materials forming swimsuit 10, material 20, and adhesive element 24. The degree of heat should not melt or otherwise damage swimsuit 10 or material 20 prior to the melting of adhesive element 24, unless the melting of swimsuit 10 and/or material 20 is intended for forming the desired bond. This consideration aside, however, the degree of heat and pressure is generally related to the specific material forming adhesive element 24. For example, a temperature of 350° Fahrenheit and a pressure of 40 pounds per square inch that is applied for 15 seconds are generally sufficient to form a bond when adhesive element 24 is a polyurethane material. Similarly, a temperature between 325 and 375° Fahrenheit and a pressure between 60 and 80 pounds per square inch that is applied for a time between 10 and 15 seconds is generally sufficient to form a bond when adhesive element 24 is a vinyl or polyamide material. Upon subsequent cooling, a portion of adhesive element 40 solidifies around the individual fibers or filaments in second textile element 30, thereby forming a secure bond.

- [23] In other embodiments, increased tension area 12 may be formed by applying material directly to swimsuit 10 without a separate layer of adhesive. For example, a material such as silicone may be applied directly to swimsuit 10, such as by silkscreening. In this embodiment, the silicone could be applied to either the interior or exterior surface of swimsuit 10. Other methods of securing a layer of material to swimsuit 10 to provide an area of increased tension will become readily apparent to those skilled in the art, given the benefit of this disclosure.
- [24] When swimsuit 10 is donned by the user, increased tension area 12, having two layers of material, will stretch less than the remaining areas of swimsuit 10, resulting in increased tension or stress in that area. This increased tension is advantageous, since the increased tension area will have a reduced tendency to form a pocket that will retain water as the user swims. This will reduce the mass carried by the user, consequently reducing drag and improving performance.
- [25] As illustrated in FIG. 3, a second increased tension area 26 is found in the lumbar region 28 of the back 30 of swimsuit 10. Second increased tension area 26 has the same construction as that described above for first increased tension area 12, namely, a piece of material 20 secured to swimsuit 10 by an adhesive element 24. In this embodiment, the material 20 that forms second increased tension area 26 has a substantially diamond shaped form, with its sides curved slightly inwardly.
- [26] As noted above, the composite of material 20 and adhesive element 24 can take any desired shape in order to minimize tenting of swimsuit 10. Another embodiment is illustrated in FIG. 4, in which an increased tension area 32 on front 14 of swimsuit 10 is formed of a pair of elongate elements 34 joined at first ends thereof at the sternum of the user. Elongate elements 34 extend outwardly and are slightly cupped shape, with a mouth of the cupped shape opening upwardly

such that the elongate elements curve slightly upwardly around the bottom of the user's pectoral muscles. A third elongate element 35 is joined at a first end thereof to the first ends of elongate elements 34, and extends upwardly along the chest of the user between the pectoral muscles. In this embodiment, a seal 37 is formed about an upper edge 39 of swimsuit 10, and elongate elements 34, 35 extend all the way to seal 37. It is to be appreciated that elongate elements 34, 35 may not extend all the way to seal 37 in certain preferred embodiments.

[27] A further embodiment is seen in FIG. 5, in which an increased tension area 36 is found in the lumbar region 28 of the back 30 of swimsuit 10. Increased tension area 36 has the shape of a flattened diamond, with a width substantially greater than its height.

[28] Yet another embodiment is shown in FIG. 6, in which an increased tension area 38 is seen on front 14 of swimsuit 10. Increased tension area 38 is similar to that shown above in FIG. 1. Increased tension area 38 is formed of three elongate elements 40, 42, 44 extending outwardly from the sternum of the user. A first elongate element 40 extends upwardly between the pectoral muscles of the user. The second and third elongate elements 42, 44 extend downwardly and outwardly from the user's sternum and are spaced approximately 120° from one another and first elongate element 40.

[29] Consequently, it can be seen and appreciated that any number of increased tension areas can be provided in swimsuit 10, and that these areas can have any desired shape. It is desirable to position such increased tension areas between anatomical high points, or elevated points, on the user's body. Thus, as noted above, increased tension areas can be provided in the space between the user's pectoral muscles, or between any two muscle groups. Other suitable areas for

positioning increased tension areas on swimsuit 10 will become readily apparent to those skilled in the art, given the benefit of this disclosure.

[30] In light of the foregoing disclosure of the invention and description of the preferred embodiments, those skilled in this area of technology will readily understand that various modifications and adaptations can be made without departing from the scope and spirit of the invention. All such modifications and adaptations are intended to be covered by the following claims.